भारतीय मानक

Indian Standard

IS 16634 : 2023

ई85 ईंधन (फ्लेक्स ईंधन संचालित सकारात्मक इग्निशन इंजन वाहनों के लिए निर्जल इथेनॉल और मोटर गैसोलीन का मिश्रण) — विशिष्टि

(पहला पुनरीक्षण)

E85 Fuel — Admixture of Anhydrous Ethanol and Motor Gasoline for Flex Fuel Positive Ignition Engine Powered Vehicles — Specification

(First Revision)

ICS 75.160.20

© BIS 2023

भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फर मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

November 2023 **Price Group 10**

Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee, PCD 03

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee had been approved by the Petroleum, Coal and Related Products Division Council.

Ethanol is an alternative fuel source that offers environment friendly characteristics associated with its use. Anhydrous ethanol meeting specifications prescribed under IS 15464 is used as blending component in motor gasoline to manufacture E10 fuel (10 percent ± 1 percent volume blend in motor gasoline) and used in existing positive ignition engines of automotive vehicles. As per the report on 'Roadmap for ethanol blending in India 2020 to 2025' released in 2021 by Government of India, the bio-fuel usage in automotive vehicles need to be increased in order to reduce emissions; achieve better environment friendly performance; encourage make in India products; and reduce the import bill. The report recommends this can be achieved by higher percentage of ethanol blending in gasoline (above E10) for automotive vehicles usage.

Accordingly, IS 17021 'E20 fuel — Admixture of anhydrous ethanol and gasoline — As fuel for spark ignited engine powered vehicles — Specification' is already published, and its implementation is planned from 2023. New vehicles, materials, engine calibration are being considered by original equipment manufacturers (OEMs) to use E20 fuel when implemented. Compatibility study of existing engines and vehicles to use E20 fuel is also in progress jointly between OEMs, oil manufacturing companies (OMCs) and testing agencies.

However, the existing gasoline vehicles or E20 compatible vehicles are not suitable using higher ethanol blends (above E20). Potential issues like reduced fuel efficiency, performance, driveability, failure of fuel system material and components over a period of usage may occur leading to leakages and other failures. To overcome such problems, flexible fuel vehicles (FFVs) need to be developed which are specially designed to operate on higher blends of ethanol, safely and effectively. The FFVs are versatile to operate on ethanol blended gasoline ranging from 20 percent up to 85 percent without adverse effects on fuel system material, emissions, on-board diagnostic (OBD) systems or drivability.

Further, higher ethanol containing fuels have lower calorific value. Hence, FFVs will be fortified with ethanol and/or oxygen sensors, other electronic engine control units which adjusts air fuel ratio of engine and provide fueling related to the oxygen content. These are required to maintain the proper stoichiometric ratio under the various engine operating loads and condition thereby to optimize emission, recover performance deterioration owing to lower energy content of ethanol. The vaporization characteristics of ethanol require modified engine fueling strategies under engine cold start and warm up conditions as well. Global references of countries using ethanol blended gasoline varying from 10 percent to 85 percent in FFV are also available.

In the preparation of this standard, considerable assistance has been derived from ASTM D5798 : 2017 — Standard specification for ethanol fuel blends for flexible-fuel automotive spark-ignition engines, and Brazil fuel standards — ANP 807 : 2020, ANP 19 : 2015.

This standard was first published in 2017. The first revision has been taken up to keep pace with the latest technological developments and international practices. Considering the future of flexible fuel vehicles in India and readiness of fuel, quality parameters of this standard are aligned with recent revision of E20 fuel and critical parameters are included in this revision which are relevant and sensible for FFV's operation and ultimately the emission compliance and durability of FFVs.

(*Continued on third cover*)

Indian Standard

E85 FUEL — ADMIXTURE OF ANHYDROUS ETHANOL AND MOTOR GASOLINE FOR FLEX FUEL POSITIVE IGNITION ENGINE POWERED VEHICLES — SPECIFICATION

(First Revision)

1 SCOPE

This standard prescribes requirements, methods of sampling and test for E85 fuel, an admixture of 80 percent to 85 percent anhydrous ethanol conforming to IS 15464 with ethanol free motor gasoline conforming to IS 2796. This E85 fuel can be used in specially designed positive ignition flex fuel vehicles directly or as a mixture with gasoline conforming to IS 2796 or as a mixture with E20 fuel conforming to IS 17021.

This standard does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this specification to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

2 REFERENCES

The standards listed in Annex A contain provisions, which through reference in this text constitute the provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of these standard.

3 TERMINOLOGY

For the purposes of this standard, the following definitions shall apply.

3.1 Ethanol — a pure organic chemical, otherwise known as hydroxyl ethane, corresponding to the constitution CH_3CH_2OH and molecular formula C_2H_5OH.

3.2 Ethyl Alcohol (Absolute Alcohol) — a clear, colorless and homogeneous liquid, consisting essentially of ethanol admixed with not more than 0.5 percent by volume of water.

3.3 Anhydrous Ethanol — essentially ethyl alcohol, with minimum 99 percent purity and having a boiling point of 78.5 °C without any denaturant. For the purpose of this standard, anhydrous ethanol refers to ethyl alcohol which is denatured as per IS 15464.

3.4 Denaturant — a substance completely miscible in ethyl alcohol and of such a character that while its addition makes the material or any aqueous dilution of it unpleasant and unwholesome for potable purposes, its presence does not render anhydrous ethanol, either as such or blended with motor gasoline, unsuitable for use in automobile engines. The denaturants and its concentration shall be as prescribed in IS 4117 and or as prescribed by central and state regulators.

3.5 Ethanol Free Motor Gasoline — refined petroleum distillate free from undissolved water, foreign matters and visible impurities, and ethanol and shall confirm to the requirement of ethanol free BS VI compliant specification of IS 2796.

4 REQUIREMENTS

4.1 Description

E85 fuel is an admixture of 80 percent to 85 percent *v/v* anhydrous ethanol conforming to IS 15464 with ethanol free motor gasoline fuel conforming to IS 2796. E85 fuel shall comply with the requirements given in the col (3) of Table 1.

4.2 Suitable stabilizing agents and additives (*see* **4.2.1** to **4.2.3**) in appropriate concentrations are permitted to be added to E85 fuel to improve its stability. Organic oxygenates, if required, used as blending components and/or stabilizing agents shall be as specified in **4.3** and the amount of such oxygenates shall comply with the limiting requirements as specified in **4.3.2**.

4.2.1 *Corrosion Inhibitors*

Suitable doses of corrosion inhibitors have to be necessarily added to the E85 fuel to prevent corrosion, which may be caused due to hygroscopic nature of ethanol added in gasoline.

4.2.2 *Antioxidants*

Suitable antioxidants may be added to motor gasoline in sufficient concentration so as to ensure oxidation stability of E85 fuel. Some antioxidants of proven chemistry are listed below (this is not an exhaustive list):

a) N,N′-disecondary-butyl-paraphenylene diamine;
b) 2,4-dimethyl-6-tertiary butyl phenol;
c) 4-methyl-2,6-ditertiary-butyl phenol;
d) N,N′-di-isopropyl-paraphenylene diamine;
e) N-butyl-p-aminophenol; and
f) Mixture of N,N′-disecondary-butyl-paraphenylene diamine and disalicylidene-N-methyl dipropylene triamine.

4.2.3 *Metal Deactivators*

Suitable metal deactivators in sufficient concentration may be added in motor gasoline to make E85 fuel compatible with the vehicle fuel system components. Some metal deactivators of proven chemistry are listed below (this is not an exhaustive list):

a) N,N′-disalicylidene-propylene-diamine;
b) N,N′-disalicylidene-ethylene diamine; and
c) N,N′-disalicylidene-methylamine-dipropylene-triamine

4.2.4 *Multi-functional Additives*

Motor gasoline multifunctional additives (MFA), other than those mentioned in **4.2.1** to **4.2.3** such as detergent/dispersant, dehazer, defoamant additives and additives containing metals such as iron, manganese (MMT) shall not be used.

4.3 Organic Oxygenates

4.3.1 *Permitted Components*

The following components may be used either individually or inmixtures as blending components or as stabilizing agents if required to prevent phase separation of the E85 fuel:

a) *Ethers* — Methyl tertiary butyl ether (MTBE), tertiary amyl methyl ether (methoxy-2-methyl butane) (TAME), ethyl tertiary butyl ether (2-ethoxy-2-methyl propane) (ETBE) and other ethers (R-O-R’) with final boiling point not exceeding 210 ºC and with molecules containing five or more carbon atoms.

4.3.2 *Concentration*

When tested as per method given in col (4) of Table 1, the concentration of the components shall comply with the limits given in col (3) of Table 1.

4.3.3 Subject to the effect of the added denaturant, anhydrous ethanol shall comply with the requirements for general purposes prescribed for ethyl alcohol (*see* IS 15464).

4.4 Other Additives Control

In order to protect automotive catalyst system, additives containing phosphorous, copper, lead and chlorine shall not be used or added or permitted in E85 fuel while manufacturing or prior to dispensing. Limit of these additives in E85 fuel when tested, shall comply with the requirements given in Table 1.

5 PACKING AND MARKING

5.1 Packing

The material shall be packed in suitable containers prescribed by the Petroleum and Explosives Safety Organization (PESO) from time to time.

5.2 Marking

5.2.1 The material shall be supplied in accordance with the marking and shipping regulations laid down by the Petroleum and Explosives Safety Organization (PESO) from time to time.

5.2.2 Each container shall also be marked legibly and indelibly with the following information:

a) Name of the material;
b) Manufacturer’s name;
c) Indication of the manufacturer details, like initials or trade-mark, if any;
d) Volume, in litres, of the contents;
e) Year of manufacture or packing; and
f) Any other statutory requirements.

5.2.3 *BIS Certification Marking*

5.2.3.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standard Act,* 2016 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

5.2.3.2 *Pump Marking and Labelling*

Information shall be marked on dispensing pumps used for delivering E85 fuel to retail consumer. It shall be clearly visible and legible and displayed at the point of dispensing where E85 is filled in the vehicles or made available to consumers. To help the customer in identifying, E85 labeling shall be used at retail outlets as given below:

Grade/Category	*To be labelled as*
85 percent ethanol blended motor gasoline	E85

6 SAMPLING

Representative samples of the material shall be drawn as prescribed in IS 1447 (Part 1).

7 QUALITY ASSURANCE

7.1 Motor gasoline fuel quality assurance should be based on batch certification during production at refineries. It is essential that refineries ensure batches are homogenous so that test results are representative of the product supplied.

7.2 At the point of manufacture, the refinery shall issue a quality certificate certifying that the batch of fuel complies with all the requirements of this standard. Following additional information shall be mentioned in the quality certificate:

a) Title and number of the Indian Standard;
b) Name and address of manufacturer;
c) Name and address of testing laboratory;
d) Batch number or unique identifier;
e) Properties tested including specification limit, test method and result of test;
f) Identification of the signatory certifying the report;
g) Date of certification; and
h) Quantity certified.

7.3 Anhydrous ethanol quality assurance shall be ensured by the supplier while supplying or by refineries or marketing depots before blending with motor gasoline to make E85 fuel.

Table 1 Requirements for E85 Fuel — Admixture of Anhydrous Ethanol and Motor Gasoline

(*Clauses* 4.1, 4.3.2 *and* 4.4)

Sl No.	**Characteristics**	**Requirements**	**Test Method — Part of IS 1448/ISO/EN/ASTM/IP**
(1)	(2)	(3)	(4)
i)	Appearance	Clear, colourless and homogeneous liquid, visibly free of suspended or precipitated contaminants	Visual
ii)	Density at 15 °C, kg/m^3	780 to 795	Part 167
iii)	Ethanol content, percentage, *v/v*	80 to 85	ASTM D5501[1)]/EN 1601
iv)	Methanol and higher alcohols (C3-C8) content, *v/v, Max*	1.0	ASTM D5501[1)]/EN 1601
v)	Motor gasoline content, percent, *v/v*	14 to 19	Annex B
vi)	Distillation characteristics		Part 18[1)]/ISO 3405
	a) Initial boiling point, °C	45 to 63	
	b) Evaporation at 70 °C, percent *v/v, Max*	15	
	c) Evaporation at 100 °C, percent *v/v, Min*	95	
	d) Evaporation at 150 °C, percent *v/v, Min*	97	
	e) Final boiling point, °C	145 to 185	
	f) Residue, percent *v/v, Max*	1	
vii)	Gum content (solvent washed) per 100 ml, g, *Max*	5	Part 29[1)]

Table 1 (*Continued*)

Sl No. (1)	**Characteristics** (2)	**Requirements** (3)	**Test Method — Part of IS 1448/ISO/EN/ASTM/IP** (4)
viii)	Total sulphur, mg/kg, *Max*	10	Part 159[1]/Part 160/ ISO 20846
ix)	Lead content (as Pb), mg/l, *Max*	3	IP 224[1] / ASTM D5059/ ASTM D3237
x)	Reid vapour pressure (RVP) at 37.8 °C, kPa, *Max*	45	Annex C[1]/ASTM D5191/ASTM D4953
xi)	Vapour lock index (VLI)	700	Annex D
xii)	Benzene content, percent by volume, *Max*	0.5	Part 181[1]/EN 238/EN 12177
xiii)	Aromatic content, percent by volume, *Max*	7	Part 23[1]/ISO 22854/ ASTM D1319
xiv)	Copper strip corrosion (3 h at 50 °C)	Class 1	Part 15
xv)	Oxidation stability, induction period, minutes, *Min*	360	Part 28
xvi)	Water content, percent by mass, *Max*	1	Part 182[1]/ASTM D6304
xvii)	Chloride content, mg/kg, *Max*	10	ASTM D5384/D4929[1]
xviii)	*p*H	6.5 to 9.0	ASTM D6423
xix)	Electrical conductivity, µS/cm, *Max*	5	Annex E[1]/EN 15938
xx)	Acidity (as acetic acid), mg/kg, *Max*	50	Annex F[1]/ASTM D7795
xxi)	Copper content, mg/kg, *Max*	0.10	EN 15837[1]/EN 15488
xxii)	Phosphorus content, mg/l, *Max*	0.15	EN 15837[1]/EN 15487
xxiii)	Engine intake system cleanliness	Report if MFA used	*see* Note

NOTE — Use of multifunctional additives (MFA) is a requirement for assuring adequate fuel system and intake system cleanliness performance in engines. Refiners/marketers of motor gasoline have to ensure the MFA has proper credentials from internationally accepted test laboratories/authorities, of having passed a minimum of one of the tests in each of the two categories of deposit control performance indicated below:

Sl No. (1)	*Deposit Type* (2)	*Test No.* (3)	*Test Equipment* (4)	*Test Method* (5)	*Pass Limit* (*Average IVD Weight*) (6)
a)	Intake valve deposit (IVD)	1	BMW IVD test	ASTM D5500-16	100 mg/valve, *Max*
		2	MB M102E IVD	CEC F-05-A-93	50 mg/valve, *Max*
		3	FORD 2.3 litre IVD	ASTM D 6201	90 mg/valve, *Max*
		4	MB M111-IVD test	CEC F-20-A-98	50 mg/valve, *Max*
			—	—	Limit (percent injector flow loss)
			—	—	Pass limit (percent injector flow loss)
b)	Port fuel injector deposit (PFI)	1	Chrysler PFI test	ASTM D5598-01(2012)	5 percent, *Max*
		2	PFI deposit rig	ASTM D6421	10 percent, *Max*

Table 1 (*Concluded*)

Sl No.	**Characteristics**	**Requirements**	**Test Method — Part of IS 1448/ISO/EN/ASTM/IP**
(1)	(2)	(3)	(4)
Other performance tests may be added as and when they reach qualified/standard test status. MFAs which are certified against national generic certification option as per US EPA-97 final rule (40 CFR Part 80 certification standards for deposit control additives) may also be used by fuel refiners/marketers at treatment levels not less than the lower additives concentration (LAC) limits, as these MFAs meet the criteria for acceptance mentioned above.			

---

[1] To be considered as referee method in case of dispute.

ANNEX A

(*Clause* 2)

LIST OF REFERRED STANDARDS

IS No./Other Standards	*Title*
IS 1447 (Part 1) : 2021	Methods of sampling of petroleum and its products: Part 1 Manual sampling (*second revision*)
IS 1448	Methods of test for petroleum and its products:
(Part 15) : 2004/ ISO 2160 : 1998	Petroleum products — Corrosiveness to copper — Copper strip test (*third revision*)
(Part 18) : 2020	Distillation of petroleum products (*third revision*)
(Part 23) : 2004/ ISO 3837 : 1993	Liquefied petroleum gases — Determination of hydrocarbon types — Fluorescent indicator adsorption method (*fourth revision*)
(Part 28) : 2008/ ISO 7536 : 1994	Petroleum products — Determination of oxidation stability of gasoline — Induction period method (*fourth revision*)
(Part 29) : 2021/ ISO 6246 : 2017	Petroleum Products — Gum content of fuels — Jet evaporation method (*fourth revision*)
(Part 159) : 2018/ ISO 20884 : 2011	Determination of sulphur content of automotive fuels — Wavelength-dispersive X-ray fluorescence spectrometry
(Part 160) : 2017/ ISO 20846 : 2011	Determination of sulphur content of automotive fuels — Ultraviolet fluorescence method
(Part 167) : 2018/ ISO 12185 : 1996	Determination of density — Oscillating U-tube method
(Part 181) : 2020/ ISO 22854 : 2016	Determination of hydrocarbon types and oxygenates in automotive motor gasoline and in ethanol (E85) automotive fuel — Multidimensional gas chromatography method
(Part 182) : 2020/ ISO 12937 : 2000	Petroleum products — Determination of water — Coulometric Karl Fischer titration method
IS 2796 : 2017	Motor gasoline — Specification (*sixth revision*)
IS 4117 : 2008	Alcohol denaturants — Specification (*second revision*)
IS 15464 : 2022	Anhydrous ethanol for use as blending component in motor gasoline — Specification (*first revision*)
IS 17021 : 2018	E20 fuel — Admixture of anhydrous ethanol and gasoline — As fuel for spark ignited engine powered vehicles — Specification
ASTM D130-19	Standard test method for corrosiveness to copper from petroleum products by copper strip test
ASTM D381-22	Standard test method for gum content in fuels by jet evaporation
ASTM D525-12	Standard test method for oxidation stability of gasoline (induction period method)

IS No./Other Standards	*Title*
ASTM D1319-20	Standard test method for hydrocarbon types in liquid petroleum products by fluorescent indicator adsorption
ASTM D1613-17	Standard test method for acidity in volatile solvents and chemical intermediates used in paint, varnish, lacquer and related products
ASTM D2622-21	Standard test method for sulfur in petroleum products by wavelength dispersive x-ray fluorescence spectrometry
ASTM D3237-22	Standard test method for lead in gasoline by atomic absorption spectroscopy
ASTM D4294-21	Standard test method for sulfur in petroleum and petroleum products by energy dispersive x-ray fluorescence spectrometry
ASTM D4929-22	Standard test method for determination of organic chloride content in crude oil
ASTM D4953-20	Standard test method for vapor pressure of gasoline and gasoline oxygenate blends (dry method)
ASTM D5059-21	Standard test methods for lead and manganese in gasoline by X-ray fluorescence spectroscopy
ASTM D5191-22	Standard test method for vapor pressure of petroleum products liquid fuels (mini method)
ASTM D5384-14	Standard test methods for chlorine in used petroleum products (field test kit method)
ASTM D5453-19	Standard test method for determination of total sulfur in light hydrocarbons, spark ignition engine fuel, diesel engine fuel, and engine oil by ultraviolet fluorescence
ASTM D5501-20	Standard test method for determination of ethanol and methanol content in fuels containing greater than 20 percent ethanol by gas chromatography
ASTM D5798-21	Standard specification for ethanol fuel blends for flexible-fuel automotive spark- ignition engines
ASTM D6304-20	Standard test method for determination of water in petroleum products, lubricating oils, and additives by coulometric Karl Fischer titration
ASTM D6423-20	Standard test method for determination of pH_e of denatured fuel ethanol and ethanol fuel blends
ASTM D7039-15	Standard test method for sulfur in gasoline, diesel fuel, jet fuel, kerosine, biodiesel, biodiesel blends, and gasoline-ethanol blends by monochromatic wavelength dispersive X-ray fluorescence spectrometry
ASTM D7319-22	Standard test method for determination of existent and potential sulfate and inorganic chloride in fuel ethanol and butanol by direct injection suppressed ion chromatography
ASTM D7328-23	Standard test method for determination of existent and potential inorganic sulfate and total inorganic chloride in fuel ethanol by ion chromatography using aqueous sample injection
ASTM D7795-15	Standard test method for acidity in ethanol and ethanol blends by titration
EN 238 : 1996	Liquid petroleum products — Petrol — Determination of the benzene content by infrared spectrometry

IS No./Other Standards	*Title*
EN 1601 : 2017	Liquid petroleum products. Unleaded petrol. Determination of organic oxygenate compounds and total organically bound oxygen content by gas chromatography (O-FID)
EN 12177 : 2022	Methods of test for petroleum and its products. Liquid petroleum products. Unleaded petroleum. Determination of benzene content by gas chromatography
EN 15487 : 2007	Ethanol as a blending component for petrol. Determination of phosphorus content. Ammonium molybdate spectrometric method
EN 15488 : 2007	Ethanol as a blending component for petrol. Determination of copper content. Graphite furnace atomic absorption spectrometric method
EN 15837 : 2009	Ethanol as a blending component for petrol. Determination of phosphorus, copper and sulfur content. Direct method by inductively coupled plasma optical emission spectrometry (ICP OES)
EN 15938 : 2010	Automotive fuels. Ethanol blending component and ethanol (E85) automotive fuel. Determination of electrical conductivity
IP 224 : 2002	Determination of low lead content of light petroleum distillates by dithizone extraction and calorimetric determination

ANNEX B

[*Table* 1, *Sl No.* (v)]

MOTOR GASOLINE CONTENT

B-1 CALCULATION OF MOTOR GASOLINE CONTENT

Motor gasoline content shall calculated as given below:

Motor gasoline content, percent, *v/v* = 100 - X - Y

where

X = ethanol content, percentage, as mentioned at Sl No. (iii) of Table 1; and
Y = methanol and higher alcohols (C3-C8) content, percentage, as mentioned at Sl No. (iv) of Table 1.

ANNEX C

[*Table* 1, *Sl No.* (x)]

TEST METHOD FOR VAPOUR PRESSURE OF GASOLINE-ALCOHOL BLEND(DRY METHOD)

C-1 GENERAL

This test method covers the determination of the absolute vapour pressure of gasoline and gasoline-oxygenate blends.

NOTE — Because the external atmospheric pressure is counteracted by the atmospheric pressure initially present in the air chamber, the 'vapour pressure' is an absolute pressure at 38 °C in kilopascals. This vapour pressure differs from the true pressure of the sample due to some small sample vaporization and the presence of air in the confined space.

C-2 SUMMARY OF TEST METHOD

The fuel chamber of the vapour pressure apparatus is filled with the chilled sample and connected to the air chamber at 38 ºC. The apparatus is immersed in a bath at 38 ºC and is shaken periodically until a constant pressure is observed on the gauge attached to the apparatus. The gauge reading, suitably corrected, is reported as the vapour pressure.

C-3 SIGNIFICANCE AND USE

The method mentioned in IS 1448 (Part 39) cannot be used to determine the vapour pressure of gasoline oxygenate blends which contain water extractable oxygenates because the fuel sample comes into contact with water. This test method is a modification of IS 1448 (Part 39) where contact with water has been eliminated.

C-4 APPARATUS

The construction of the required apparatus is described in **A-5** of IS 1448 (Part 39).

C-5 REAGENTS

C-5.1 Purity of Reagents

Use reagent grade chemicals in all tests. Unless otherwise indicated, it is intended that all reagents conform to the relevant Indian Standards where such specifications are available. Other grades may be used, provided it is first ascertained that the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination.

C-5.2 Acetone

WARNING — Extremely flammable, irritating to skin, eyes and mucous membranes.

C-5.3 Naphtha

NOTE — Naphtha [tag closed cup flash point below - 6 ºC].

WARNING — Extremely flammable. Harmful if inhaled. Skin irritant on repeated contact. Aspiration hazard.

C-6 HANDLING OF SAMPLES

C-6.1 The extreme sensitivity of vapour pressure measurements to losses through evaporation and the resulting changes in composition is such as to require the utmost precaution and the most meticulous care in the handling of samples. The provisions of this section apply to all samples for vapour pressure determinations.

C-6.2 Sample in accordance with IS 1447 (Part 1) except that water displacement must not be used.

C-6.3 Sample Container Size

The size of the sample container from which the vapour pressure sample is taken is 1 litre. It shall be 70 percent to 80 percent filled with the sample.

C-6.4 Precautions

C-6.4.1 Determine vapour pressure as the first test run on a sample. Do not withdraw more than one sample from the sample container for this test.

C-6.4.2 Protect samples from excessive heat prior to testing.

C-6.4.3 Do not test samples in leaky containers. Discard them and obtain new samples.

C-6.4.4 Discard samples that have separated into two phases and obtain new samples (*see* Notes under **C-8.3**).

C-6.5 Sample Handling Temperature

In all cases, cool the sample container and contents to 0 ºC to 1 ºC before the container is opened. To ensure sufficient time to reach this temperature, directly measure the temperature of a similar liquid in a similar container placed in the cooling bath at the same time as the sample.

C-7 PREPARATION FOR TEST

C-7.1 Verification of Sample Container Filling

With the sample at a temperature of 0 ºC to 1 ºC, take the container from the cooling bath, wipe dry with an absorbent material, unseal it, and examine its ullage. The sample content, as determined by use of a suitable gauge, shall be equal to 70 percent to 80 percent of the container capacity.

C-7.1.1 Discard the sample if its volume is less than 70 percent of the container capacity.

C-7.1.2 If the container is more than 80 percent full, pour out enough sample to bring the container contents within the 70 percent to 80 percent range. Under no circumstances, may any sample that is poured out, be returned to the container.

C-7.2 Air Saturation of Sample in Sample Container

C-7.2.1 With the sample again at a temperature of 0 ºC to 1 ºC, take the container from the cooling bath, wipe it dry with an absorbent material, unseal it momentarily, taking care to prevent water entry, reseal it, and shake it vigorously. Return it to the bath for a minimum of 2 min.

C-7.2.2 Repeat **C-7.2.1** twice more. Return the sample to the bath and keep it there until the beginning of the procedure (*see* **C-8**).

C-7.3 Preparation of Fuel Chamber

Observe the apparatus preparation procedure of **C-8.5**, then store the stoppered fuel chamber and the sample transfer connection in a refrigerator or ice-water bath for a sufficient time to allow the chamber and the connection to reach a temperature of 0 ºC to 1 ºC. If an ice-water bath is used, keep the chamber upright and not immersed over the top of the coupling threads. The transfer connection is inserted over the top of the coupling threads. The transfer connection is inserted into a plastic bag to keep it completely dry during cooling.

C-7.4 Preparation of Air Chamber

Observe the apparatus preparation procedure of **C-8.5**. Connect the gauge to the air chamber and close the lower opening securely with a dry No. 6 rubber stopper. Make sure the stopper is inserted far enough to securely close the vent hole in the air chamber connection. Immerse the air chamber to at least 25 mm above its top in the water bath until the fuel chamber has been filled with the sample as described in **C-8.1**.

C-8 PROCEDURE

C-8.1 Sample Transfer

Remove the chilled sample container from the bath, dry it with absorbent material, uncap it, and dry and insert the chilled transfer apparatus (*see* Fig. 1). Quickly place the chilled fuel chamber, in an inverted position, over the sample delivery tube of the transfer apparatus. Invert the entire system rapidly so that the fuel chamber is upright, with the end of the delivery tube touching the bottom of the fuel chamber. Fill the fuel chamber to the overflowing. Withdraw the delivery tube from the fuel chamber while allowing the sample to continue flowing up to the moment of complete withdrawal.

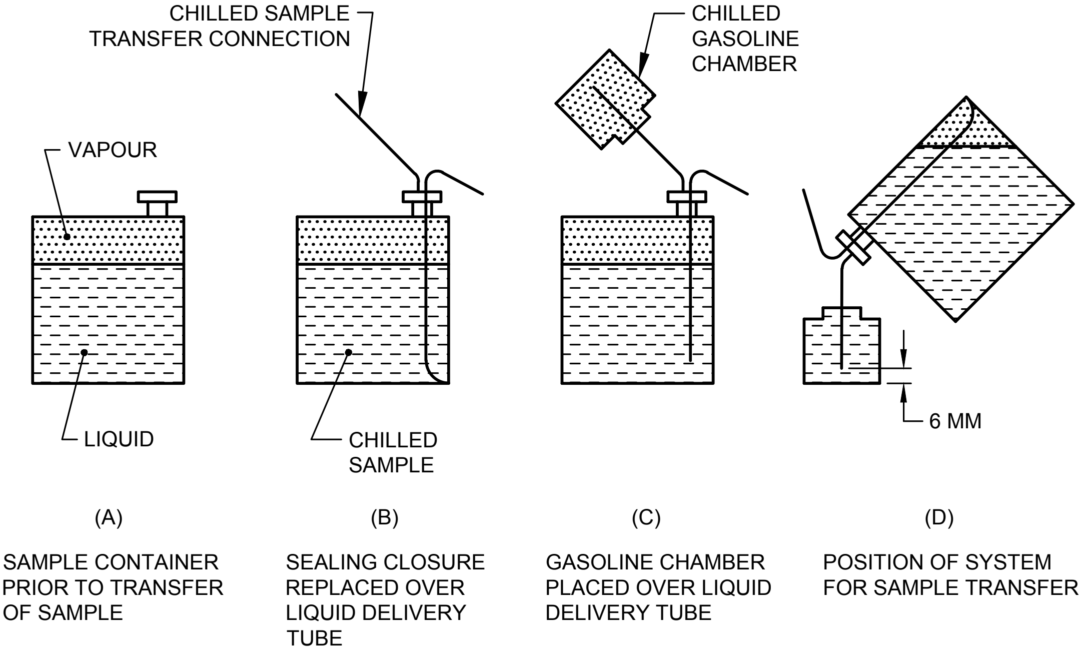
CHILLED SAMPLE TRANSFER CONNECTION
CHILLED GASOLINE CHAMBER
VAPOUR
LIQUID
CHILLED SAMPLE
6 MM
(A)
SAMPLE CONTAINER PRIOR TO TRANSFER OF SAMPLE
(B)
SEALING CLOSURE REPLACED OVER LIQUID DELIVERY TUBE
(C)
GASOLINE CHAMBER PLACED OVER LIQUID DELIVERY TUBE
(D)
POSITION OF SYSTEM FOR SAMPLE TRANSFER

FIG. 1 SIMPLIFIED SKETCHES OUTLINING METHOD OF TRANSFERING SAMPLES TO GASOLINE CHAMBER FROM OPEN-TYPE CONTAINERS

CAUTION — Make provision for suitable collection and disposal of the overflowing fuel to avoid fire hazard.

C-8.2 Assembly of Apparatus

Immediately remove the air chamber from the water bath and immediately dry the exterior of the chamber with absorbent material giving particular care to the connection between the air chamber and the fuel chamber. Remove the stopper after drying and immediately couple the two chambers. Not more than 10 s shall be consumed in coupling the two chambers.

NOTE — When the air chamber removed from the water bath is dried and the stopper is removed, connect it to the fuel chamber without undue movements through the air which could promote exchange of room temperature air with the air at 38 ºC in the chamber.

C-8.3 Introduction of Apparatus into Bath

Turn the assembled vapour pressure apparatus upside down to allow the sample in the fuel chamber to run into the air chamber. With the apparatus still inverted, shake it vigorously eight times in a direction parallel to the length of the apparatus. With the gauge end up, immerse the assembled apparatus in the bath, maintained at 38 ºC ± 0.1 ºC in an inclined position so that the connection of the fuel and air chambers is below the water level and may be carefully examined for leaks 25 mm above the top of the air chamber. Observe the apparatus for leakage throughout the test. Discard the test at any time a leak is detected.

NOTES

1 Liquid leaks are more difficult to detect than vapour leaks, and because the coupling between the chambers is normally in the liquid section of the apparatus give the coupling particular attention.

2 After the apparatus has been immersed in the bath check the remaining sample for phase separation. If the sample is contained in a glass container, this observation can be made prior to sample transfer (*see* **C-8.1**). If the sample is contained in a non-transparent container, shake the sample vigorously for 5 s and then immediately pour a portion of the remaining sample into a clear glass container. Immediately after shaking this sample again for 5 s, observe the sample for phase separation. If this sample is not clear and bright, and free of a second phase, discard the test and the sample.

C-8.4 Measurement of Vapour Pressure

After the assembled vapour pressure apparatus has been immersed in the bath for at least 5 min, tap the pressure gauge lightly and observe the reading. Withdraw the apparatus from the bath and repeat **C-8.3**.

At intervals of not less than 2 min, perform **C-8.3** until a total of not less than five shakings and gauge readings have been made continuously, thereafter, if necessary, until the last two consecutive gauge readings are constant, indicating equilibrium attainment.

These operations normally require 20 min to 30 min. Read the final gauge pressure to the nearest 0.25 kPa for gauges with intermediate graduations of 0.5 kPa or less than to the nearest 0.5 kPa for gauges with graduations of 1.0 kPa to 2.5 kPa and record the values as the 'uncorrected vapour pressure' of the sample. Without undue delay remove the pressure gauge and, without attempting to remove any liquid which may be trapped in the gauge, check its reading against that of the manometer while both are subjected to a common steady pressure which is no more than 1.0 kPa different from the recorded 'uncorrected vapour pressure'. If a difference is observed between the gauge and manometer readings, the difference shall be added to or subtracted from the 'uncorrected vapour pressure' recorded for the sample being tested, and the resulting value shall be recorded as the vapour pressure of the sample.

NOTES

1 Cooling the assembly prior disconnecting the gauge will facilitate disassembly and reduce the amount of hydrocarbon vapour released into the room.

2 *Verification of sample integrity* — Disconnect the air chamber from the fuel chamber. Drain the sample from the air and fuel chambers as completely as possible into a dry 240 ml clear glass bottle. Seal the bottle and shake it vigorously for 5 s. If the sample is clear and bright and free of a second phase, note this observation and record the test as valid. If the sample is not clear and bright and free of second phase, immerse the bottle in the 38 ºC water bath up to about 25 mm above the top of the sample level for 15 min in order to heat the sample to the test temperature. Remove the sample from the water bath and immediately shake it vigorously for 5 s and observe the sample. If the sample is not clear and bright and free of second phase, note this observation and record that the test is not valid because of phase separation. A fuel that is not clear and bright and free of second phase at this point of the test indicates that the fuel was contacted with sufficient water to exceed the water tolerance of the fuel during the test procedure. Water can most likely get into the test chambers during preparation of the fuel and air chambers (*see* **C-7.3** and **C-7.4**) or assembly of the air and fuel chambers (*see* **C-8.2**), or both, if water baths are used for these procedures.

C-8.5 Preparation of Apparatus for Next Test

Thoroughly purge the air chamber of residual sample by filling it with warm water above 32 ºC and allowing it to drain. Repeat the purging at least five times. After disconnecting the pressure gauge from its manifold connection with the manometer, remove trapped centrifugal thrusts. This may be accomplished in the following manner hold the gauge between the palms of the hands with the right hand on the face side and the threaded connection of the gauge forward. Extend the arms forward and upward at an angle of 45º with the coupling of the gauge pointing in the same direction. Swing the arms downward through an arc of about 135º so that the centrifugal force aids gravity in removing the trapped liquid. Repeat this operation three times to expel all liquid. Purge the pressure gauge by directing a small jet of air into its Bourdon tube for at least 5 min. Rinse both chambers and the sample transfer connection several times with petroleum naphtha, then several times with acetone, then blow dry using dried air. Stopper the fuel chamber and place it in the refrigerator or ice-water bath for the next test.

NOTE — If the purging of the air chamber is done in a bath, be sure to avoid small and unnoticeable films of floating sample by keeping the bottom and top opening of the chamber closed as they pass through the water surface.

C-9 PRECAUTIONS

C-9.1 Gross errors can be obtained in vapour pressure measurements, if the prescribed procedure is not followed carefully. The following list emphasizes the importance of strict adherence to the precautions given in the procedure.

C-9.1.1 *Checking the Pressure Gauge*

Check all gauges against a manometer after each test in order to ensure high precision of results (*see* **C-8.4**). Read all gauges while the gauges are in a vertical position and after tapping them lightly.

C-9.1.2 Shake the container vigorously to ensure equilibrium of the sample with the air in the container (*see* **C-7.2**).

C-9.1.3 *Checking for Leaks*

Check the apparatus before and during each test for both liquid and vapour leaks.

C-9.1.4 *Sampling*

Because initial sampling and the handling of samples will greatly affect the final results, employ the utmost precaution and the most meticulous care to avoid losses through evaporation and even slight changes in composition (*see* **C-6.5** and **C-8.1**). In no case shall any part of the apparatus itself be used as the sample container prior to actually conducting the test.

C-9.1.5 *Purging the Apparatus*

Thoroughly purge the pressure gauge, the fuel chamber and the air chamber to be sure they are free of residual sample. This is most conveniently done at the end of the previous test (*see* **C-8.5**). It is important to remove all water from the apparatus before cooling the gasoline chambers and heating the air chamber. In high-humidity conditions be alert for and avoid condensation on the transfer connection and interior walls of the apparatus.

C-10 REPORT

Report to the nearest 0.25 kPa or 0.5 kPa the gauge result observed in (*see* **C-8.4)**, after correcting for any difference between the gauge and manometer, as the vapour pressure in kilopascals without reference to temperature.

C-11 PRECISION AND BIAS

C-11.1 Precision

The following criteria should be used for judging the acceptability of results at 95 percent confidence level.

C-11.1.1 *Repeatability*

The difference between successive test results obtained by the same operator with the same apparatus under constant operating conditions on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following value only in one case in twenty.

Component (*Range*)	*Repeatability* (kPa)
0 kPa to 100 kPa	4.90

C-11.1.2 *Reproducibility*

The difference between two single and independent results, obtained by different operators working in different laboratories on identical test material would, in the long run, in the normal and correct operation of the test method, exceed the following value only in one case in twenty.

Component (*Range*)	*Repeatability* (kPa)
0 kPa to 100 kPa	7.790

C-11.2 Bias

There being no criteria for measuring bias in these test-product combinations, no statement of bias can be made.

ANNEX D

[*Table* 1, *Sl No.* (xi)]

DETERMINATION OF VAPOUR LOCK INDEX (VLI)

D-1 CALCULATION OF VLI

Vapour lock index shall be calculated as given below:

Vapour lock index (VLI) = 10 × RVP + 7 × E70

where

RVP = Reid vapour pressure, as mentioned at Sl No. (x) of Table 1; and

E70 = Distillation characteristics occuring at evaporation at 70 °C, as mentioned at Sl No. (vi) (b) of Table 1.

ANNEX E

[*Table* 1, *Sl No.* (xix)]

DETERMINATION OF ELECTRICAL CONDUCTIVITY

E-1 GENERAL

This test method is applicable to field and routine laboratory measurements of electrical conductivity using static samples. This test method utilizes dip-type or pipet-type conductivity cells for testing static samples. Temperature control and correction methods are also provided.

E-2 DETERMINATION OF CELL CONSTANT

E-2.1 For the purposes of this test method, the cell constant of the conductivity cell used shall be known within ± 1 percent. The manufacturer’s certification of the cell constant within this accuracy is generally considered satisfactory but the user is advised that damage could occur in shipment and it is best to re-check the cell constant when received. If the conductivity cell has been in service for a period subsequent to this certification, it shall be re-checked by the manufacturer, or in the laboratory.

E-2.2 Rinse the conductivity cell several times with water, then at least twice with the KCl reference solution that has conductivity nearest to that of the sample under test. Measure the resistance of the cell. Repeat the measurement on additional portions of the KCl reference solution until the value obtained remains constant.

E-2.3 For instruments reading measured conductance in Siemens, calculate the cell constant:

$$J = 10^{-6} \times (K_1 + K_2)/K_X$$

where

J = cell constant, cm^{-1};

K_1 = conductivity, µS/cm, of the KCl in the reference solution at the temperature of measurement;

K_2 = conductivity, µS/cm, of the water used to prepare the reference solution, at the same temperature of measurement; and

K_X = measured resistance, ohm.

NOTE — Since the conductivities of a mixture of two solutions are not exactly additive, use of $K_1 + K_2$ is only an approximation and requires that K_2 be much smaller than K_1.

E-3 PROCEDURE

E-3.1 Precision Method (Using Temperature Control)

Use a dip-type or pipet-type cell. Rinse the cell, container, and thermometer thoroughly several times with water and then two or three times with the sample. Adjust the temperature to 15.6 °C ± 1 °C. Allow sufficient time for equalization of temperatures. Read the conductance. Calculate conductivity according to **E-4** using Q = 1, since temperature correction is required.

E-3.2 Routine Method (Using Temperature Correction)

Use a dip-type or pipet-type cell. Rinse the conductivity cell thoroughly several times with water and then two or more times with the sample. Measure the resistance and the temperature (to the nearest 0.1 °C), on successive portions of the sample until a constant value is obtained. If the measuring instrument is provided with a manual temperature compensator, adjust this to the sample temperature value before reading the instrument. If an automatic temperature compensator is provided, no adjustment is necessary, but sufficient time must be allowed to permit equalization of temperature. If instrument temperature compensation is used, calculate conductivity according to **E-4** using Q = l.

E-4 CALCULATION

For instruments reading measured conductance in Siemens, calculate the conductivity of the sample:

$$K = 10^6 \times J \times K_X / Q$$

where

K = conductivity, µS/cm, at 25 °C;
J = cell constant, cm^{-1};
K_X = measured resistance, ohm; and
Q = temperature correction factor.

ANNEX F

[*Table* 1, *Sl No*. (xx)]

TEST FOR ALKALINITY AND DETERMINATION OF ACIDITY

F-1 GENERAL

Acidity is defined as a quality, state or degree of being acid. Very dilute aqueous solutions of low molecular weight organic acids (acetic acid) may be present in the anhydrous ethanol which are highly corrosive to many metals in vehicle operation when used as E85 (after blending with gasoline). It is therefore necessary to measure and keep such acids at a very low level in the E85 fuel.

This test method estimates the amount of acid by titrating with alkali (NaOH) and report as acetic acid (CH_3COOH) in mg/l.

F-2 REAGENTS

F-2.1 Standard Sodium Hydroxide Solution — 0.l N (*see* IS 2316)

F-2.2 Phenolphthalein Indicator — (*see* IS 2263)

Dissolve 0.5 g of phenolphthalein in 100 ml of rectified spirit and carefully add standard sodium hydroxide solution till the colour is rendered faintly pink.

F-3 PROCEDURE

F-3.1 Place 100 ml of water and a few pieces of clean porous pot in a 500 ml conical flask, and boil gently for 5 min to eliminate carbon dioxide. Cool slightly and add 100 ml of the sample. Boil gently for a further period of 5 min. At the end of this period, close the neck of the flask with a stopper carrying a soda-lime guard tube, and allow to cool. When cool, examine for alkalinity; if not alkaline, titrate with standard sodium hydroxide solution using a micro-burette.

F-3.2 Determine the specific gravity of the material at room temperature using a specific gravity bottle or a pycnometer or a suitable hydrometer.

F-4 CALCULATION AND REPORTING

F-4.1 Report whether the material is alkaline or acidic.

F-4.2 Calculate the acidity, if any, in terms of acetic acid and express as percentage by weight of the material taken for the test:

$$\text{Acidity (as } CH_3COOH\text{), mg/1} = 600 \times V \times N$$

where

V = volume, in ml, of standard sodium hydroxide solution required for the titration; and
N = normality of standard sodium hydroxide solution.

ANNEX G

(*Foreword*)

COMMITTEE COMPOSITION

Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee, PCD 03

Organization	*Representative(s)*
Indian Oil Corporation (R & D Centre), Faridabad	Dr S. S. V. Ramakumar **(*Chairperson*)** Dr Ajay Kumar Arora
Afton Chemicals Private Limited, Mumbai	Shri Anand Kumar
Ashok Leyland Limited, Chennai	Shri Mahesh P. Shri Balakrishnan D. (*Alternate*)
Association of State Road Transport Undertakings, New Delhi	Capt V. V. Ratnaparkhi Shri R .R .K .Kishore (*Alternate*)
Automotive Research Association of India, Pune	Shri M. A. Bawase Shri M. I. Jamadar (*Alternate*)
Bajaj Auto Limited, Pune	Shri Yogesh. R. Mahajan Shri Ramesh Goykar (*Alternate*)
Bharat Oman Refineries Limited, Sagar	Shrimati Asawari Kelkar Shri Bala Krishan Sridhar (*Alternate*)
Bharat Petroleum Corporation Limited, Mumbai	Shri R. Subramanian Shri C. Shanmuganathan (*Alternate*)
Bio Diesel Association of India, Mumbai	Shri N. S. Balamukundan Shri Sanjeev Gupta (*Alternate*)
Biogas Forum India, New Delhi	Shri A. R. Shukla
Bosch Limited, Bengaluru	Shri Fredrick A.
Central Pollution Control Board, (Ministry of Environment & Forests), New Delhi	Shri Dinabandhu Gouda
Centre for High Technology, New Delhi	Shri P. Raman Dr N. S. Raman (*Alternate* I) Shri Shekar Kulkarni (*Alternate* II)
Centre for Science and Environment, New Delhi	Shri Anumita Roy Chowdhury Shri Vivek Chattopadhyaya (*Alternate*)
Chennai Petroleum Corporation Limited, Chennai	Dr V. Selvavathi Shri H. Ramakrishnan (*Alternate*)
Concert Trust, Consumers Association of India, Chennai	Shri K. Krishnakumar Shri M. Somasundaram (*Alternate*)
Consumer Guidance Society of India, Mumbai	Dr Sitaram Dixit Dr M. S. Kamath (*Alternate*)

Organization	*Representative(s)*
CSIR - Indian Institute of Petroleum, Dehradun	Dr Anjan Ray Dr Thallada Bhasker (*Alternate*)
DRDO - Centre for Military Airworthiness and Certification, Bengaluru	Shri R. Shanmugavel Shri R. Kamalakannan (*Alternate*)
Directorate General of Aeronautical Quality Assurance, New Delhi	Shri Santosh Namdeo
Directorate General of Civil Aviation, New Delhi	Shri Rakesh Kumar Shri Amit Gupta (*Alternate* I) Shri Dharmendra Singh Yadav (*Alternate* II)
Directorate General of Quality Assurance, Ministry of Defence, Kanpur	Dr Om Prakash Singh Shri A. K. Kanaujia (*Alternate*)
Federation of Indian Petroleum Industry, New Delhi	Shri D. L. N. Sastri
General Motors India Private Limited, Halol	Shri Sunil P. S. Shri Rajendra Khile (*Alternate*)
Gulf Oil Lubricants India Limited, Mumbai	Shri Sanjay Kumar Shri Jencen Mathai Arivannoor (*Alternate*)
Hero Motocorp Limited, New Delhi	Shri Feroz Ali Khan Shri Rakesh Sharma (*Alternate*)
Hindustan Petroleum Corporation Limited, Mumbai	Shri Elecheran Kumar Shri Santosh Dhaku Bhogale (*Alternate* I) Shri Shitanshu Pati Tripathi (*Alternate* II)
Honda Cars, Noida	Shri Tarun Bhat Shri N. S.Talib (*Alternate*)
Indian Oil Corporation (MKTG), Mumbai	Shri Manish Malhan Shri A. S. Krishnamoorthy (*Alternate*)
Indian Oil Corporation (R & D Centre), Faridabad	Dr Ajay Kumar Arora
Indian Oil Corporation Limited - Refineries and Pipelines Division, New Delhi	Shri R. K. Kaushik Singha Dr Vartika Rastogi (*Alternate*)
Lubrizol India Limited, Mumbai	Shri Anand Redkar
Mahindra and Mahindra Limited, Mumbai	Shri R. Ramaprabhu
Mangalore Refinery and Petro Chemical Limited, Mangaluru	Shri V. Nanda Kumar Shri Sudheer Pai M. (*Alternate*)
Maruti Udyog Limited, Gurugram	Shri Ajay Kumar Shri Nishant Sarna (*Alternate* I) Shrimati Abha Rani (*Alternate* II)
Ministry of New and Renewable Energy, New Delhi	Shri S. K. Jagwani Dr Vasantha Thakur (*Alternate*)

Organization	*Representative(s)*
Ministry of Petroleum and Natural Gas, New Delhi	Shri Manish Sarda Shri Rajesh Manocha (*Alternate*)
Ministry of Railways, Lucknow	Shri Rajesh Srivastava Shrimati Sonam Gupta (*Alternate*)
Nayara Energy Limited, Mumbai	Shri Mriganka Tarafdar Shri Pratik Shah (*Alternate* I) Shri Sabyasachi Kumar (*Alternate* II)
Oil and Natural Gas Corporation Limited, New Delhi	Shri Gour Mohan Dass Shrimati Leena John (*Alternate* I) Shri Dinesh S. R. Reddy Kakuturi (*Alternate* II)
Petroleum and Explosives Safety Organization, Nagpur	Shri Vivek Kumar Shri H. P. Sangole (*Alternate*)
Reliance Industries Limited, Mumbai	Shri Balasubramanian K. Shri Sanjai Tiwari (*Alternate*)
Society of Indian Automobile Manufacturers (SIAM), New Delhi	Shri Prashant Kumar Banerjee Dr Sandeep Garg (*Alternate* I) Shri Diwit Prajapati (*Alternate* II)
TVS Motor Company Limited, Hosur	Dr Jabez Dhinagar Shri M. S. Anand Kumar (*Alternate*)
Tata Motors Limited, Pune	Shri Sethuramalingam Tyagarajan Shri Gowrishankar P. S. (*Alternate*)
In Personal Capacity (*Flat - 1002, Raheja Heights, D - Wing, off Gen A K Vaidya Marg, Dindoshi, Malad East Mumbai - 400097*)	Dr Y. P. Rao
BIS Directorate General	Shrimati Meenal Passi, Scientist 'F'/ Senior Director and Head (Petroleum, Coal and Related Products) [Representing Director General (*Ex-officio*)]

Member Secretary

Shrimati Kreeti Das
Scientist 'C'/Deputy Director
(Petroleum, Coal and Related Products), BIS

Automotive, Aviation and Industrial Fuels Subcommittee, PCD 3 : 1

Organization	*Representative(s)*
In Personal Capacity (*Flat - 1002, Raheja Heights Heights, D - Wing, off Gen A K Vaidya Marg, Dindoshi, Malad East Mumbai - 400097*)	DR Y. P. RAO **(*Convener*)**
Ashok Leyland Limited, Chennai	SHRI SENTHIL KUMAR G. SHRI MUTHUKUMAR N. (*Alternate*)
Automotive Research Association of India, Pune	SHRI M. A. BAWASE SHRI M. I. JAMADAR (*Alternate*)
Bajaj Auto Limited, Pune	SHRI YOGESH R. MAHAJAN SHRI RAMESH GOYKAR (*Alternate*)
Bharat Oman Refineries Limited, Bina	SHRIMATI ASAWARI KELKAR SHRI BALA KRISHNAN SRIDHAR (*Alternate*)
Bharat Petroleum Corporation Limited, Mumbai	SHRI C. SHANMUGANATHAN SHRI V. RAJESH (*Alternate*)
Bosch Limited, Bengaluru	SHRI A. FREDRICK
BPCL Refineries Limited, Kochi	SHRI ADALAZHAGAN K.
Central Revenue Control Laboratory, New Delhi	DR. Y. K. S. RATHORE
Centre for High Technology, New Delhi	DR P. RAMAN DR N. S. RAMAN (*Alternate*)
Centre for Science and Environment, New Delhi	MS ANUMITA ROYCHOWDHURY SHRI VIVEK CHATOPADYAY (*Alternate*)
Chennai Petroleum Corporation Limited, Chennai	DR V. SELVAVATHI SHRI H. RAMAKRISHNAN (*Alternate*)
CIMAC India, Faridabad	SHRI N. K. BANSAL
Concert Trust, Consumers Association of India, Chennai	SHRI K. KRISHNAKUMAR SHRI M. SOMASUNDARAM (*Alternate*)
CSIR - Indian Institute of Petroleum, Dehradun	DR ANIL KUMAR SINHA DR SUNIL KUMAR PATHAK (*Alternate*)
Directorate General of Civil Aviation, New Delhi	SHRI AMIT GUPTA SHRI RAKESH KUMAR (*Alternate*)
Directorate General of Quality Assurance, Ministry of Defence, New Delhi	DR OM PRAKASH SINGH SHRI A. K. KANAUJIA (*Alternate*)
Directorate of Indigenisation, New Delhi	GP CAPT ASHEESH SHRIVASTAVA
DRDO - Centre for Military Airworthiness and Certification, Bengaluru	SHRI R. SHANMUGAVEL DR R. KAMALA KANNAN (*Alternate*)
Federation of Indian Petroleum Industry, New Delhi	SHRI D. L. N. SASTRI
Gulf Oil Lubricants India Limited, Mumbai	SHRI SANJAY KUMAR SHRI JENCEN MATHAI ARIVANNOOR (*Alternate*)

Organization	*Representative(s)*
Hero Motocorp Ltd, Gurugram	Shri Feroz Ali Khan Shri Rakesh Sharma (*Alternate*)
Hindustan Petroleum Corporation Ltd, Mumbai	Shri Elecheran Kumar Shri Santosh Dhaku Bhogale (*Alternate* I) Shri Shitanshu Pati Tripathi (*Alternate* II)
Honda Cars, Noida	Shri Tarun Bhat Shri N. S. Talib (*Alternate*)
HP Green Research and Development Centre, Bengaluru	Shri B. Ravi Shri K. R. Krishna (*Alternate*)
Indian Institute of Technology Delhi, New Delhi	Prof V. K. Vijay
Indian Oil Corporation (R and D Centre), Faridabad	Dr A. K. Arora Dr Maya Chakradhar (*Alternate*)
Indian Oil Corporation Limited — Refineries and Pipelines Division, New Delhi	Dr Vartika Rastogi Ms Soma Chattopadhyay (*Alternate*)
Indian Oil Corporation Limited (MKTG), Mumbai	Shri Manish Malhan Shri Krishnamoorthy A. S. (*Alternate*)
Indian Sugar Mills Association, New Delhi	Shri G. K. Thakur
Kaleesuwari Refinery and Industry Private Limited, Kakinada	Shri Shyam Sundar Sai Nudurupati
Lubrizol India Limited, Mumbai	Shri Anand Redkar Shri Puneet Verma (*Alternate*)
Mahindra and Mahindra Limited, Mumbai	Shri R. Ramaprabhu
Mangalore Refinery and Petro Chemical Limited, Mangaluru	Shri Anitha Shetty Shri Yogeesha (*Alternate*)
Maruti Udyog Ltd, Gurugram	Shri Ajay Kumar Shri Nishant Sarna (*Alternate*)
Ministry of New and Renewable Energy, New Delhi	Shri S. K. Jagwani Dr Vasantha Thakur (*Alternate*)
Ministry of Petroleum and Natural Gas, New Delhi	Shri Manish Sarda Shri Rajesh Manocha (*Alternate*)
Nayara Energy, Mumbai	Shri Pratik Shah Shri Sabyasachi Kumar (*Alternate*)
Numaligarh Refinery Limited, Golaghat	Shri Bimlesh Gupta Shri Pallab Das (*Alternate*)
ONGC, New Delhi	Shri Gour Mohan Das Shrimati Leena John (*Alternate*)
RDSO, Ministry of Railways, Lucknow	Shri A. K. Sabharwal Dr D. K. Konar (*Alternate*)

Organization	*Representative(s)*
Reliance Petroleum Limited, Mumbai	SHRI K. BALASUBRAMANIAN SHRI SANJAY TIWARI (*Alternate*)
Society for Petroleum Laboratory — Fuel Testing Laboratory, Noida	DR AJAY KUMAR GUPTA SHRI A. K. SEHGAL (*Alternate*)
Society of Indian Automobile Manufacturers (SIAM), New Delhi	SHRI PRASHANT KUMAR BANERJEE DR SANDEEP GARG (*Alternate*)
Tata Motors Limited, Pune	SHRI T. SETHURAMALINGAM SHRI PALLIPALAYAM GOWRISHANKAR (*Alternate*)
Ultra Plus Lubes Private Limited, Panvel	SHRI SIDDESH N. SAVANT SHRI N. C. SEKHARAN (*Alternate*)
In Personal Capacity (*A123, Iris court, Mahindra World City, Paranur, Chengalpattu - 603002*)	SHRI MATHEW ABRAHAM

(*Continued from second cover*)

In this revision, the following major changes have been incorporated:

a) Title of the standard has been revised;

b) Requirements of appearance, aromatic content, benzene, distillation, lead, and vapour lack index incorporated; and

c) Requirements of density, ethanol content, gasoline content, sulphur and chloride content, electrical conductivity and reid vapour pressure (RVP) revised.

These parameters have incorporated/revised on the basis of test data of E85 fuel, for which analysis was carried out in the laboratories of the OMCs that are members of the Petroleum and their Related Products of Synthesis or Biological Origin Sectional Committee.

The composition of the Committee responsible for the formulation of this standard is given in Annex G.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Bureau of Indian Standards

BIS is a statutory institution established under the *Bureau of Indian Standards Act*, 2016 to promote harmonious development of the activities of standardization, marking and quality certification of goods and attending to connected matters in the country.

Copyright

BIS has the copyright of all its publications. No part of these publications may be reproduced in any form without the prior permission in writing of BIS. This does not preclude the free use, in the course of implementing the standard, of necessary details, such as symbols and sizes, type or grade designations. Enquiries relating to copyright be addressed to the Head (Publication & Sales), BIS.

Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the website-www.bis.gov.in or www.standardsbis.in.

This Indian Standard has been developed from Doc No.: PCD 03 (20736).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002
Telephones: 2323 0131, 2323 3375, 2323 9402 *Website*: www.bis.gov.in

Regional Offices: *Telephones*

Central : 601/A, Konnectus Tower -1, 6th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002 { 2323 7617

Eastern : 8th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091 { 2367 0012, 2320 9474

Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019 { 265 9930

Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113 { 2254 1442, 2254 1216

Western : Plot No. E-9, Road No.-8, MIDC, Andheri (East), Mumbai 400093 { 2821 8093

Branches : AHMEDABAD. BENGALURU. BHOPAL. BHUBANESHWAR. CHANDIGARH. CHENNAI. COIMBATORE. DEHRADUN. DELHI. FARIDABAD. GHAZIABAD. GUWAHATI. HIMACHAL PRADESH. HUBLI. HYDERABAD. JAIPUR. JAMMU & KASHMIR. JAMSHEDPUR. KOCHI. KOLKATA. LUCKNOW. MADURAI. MUMBAI. NAGPUR. NOIDA. PANIPAT. PATNA. PUNE. RAIPUR. RAJKOT. SURAT. VISAKHAPATNAM.

Published by BIS, New Delhi